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Brief 69-10364

NASA TECH BRIEF

Pressure Transducer

The problem:

To devise a simple pressure-sensitive transducer for measuring and controlling force or torque. In setting eyelet terminals in relatively fragile substrates in the manufacture of electronic components, for example, it is essential to exert only that force necessary to set the terminal properly without exceeding the compressive strength of the substrate. Systems now available for this purpose are elaborate and expensive, and they usually involve the use of strain gages and amplifiers. Torque wrenches and other similar devices place a prescribed tension only on the metal of the fastener, and this is unrelated to the crushing force applied on the mounted component.

The solution:

A novel transducer, consisting of a series of spindle-supported electrically conductive metal washers connected to electrical sensing circuitry, which can be used to determine the crushing force exerted between a mounting bolt and its nut on a plastic or other relatively fragile component. This force can be determined for any number of turns of the nut and even for portions of each individual turn. Such information will be useful for developing fastening specifications for installing mounting bolts and nuts used to secure electronic components and assemblies. Heretofore it has not been possible to develop this information.

How it's done:

The transducer is made up of a stack of incompressible metal washers, each of which is separated by resilient electrically insulative spacers made of a novel material. The spacers are progressively deformable in proportion to the applied pressure. The metal washers serve as electrical switches, which are closed in sequence as successive insulative spacers are compressed, to indicate incremental levels of pressure.

The spacers are fabricated from materials having controlled resilience. This makes it possible for spacers located in different portions of the stack to have various degrees of resilience. The metal washers, on the other hand, are virtually incompressible. Thus it is possible, by means of controlled resilience of the spacers, to determine the magnitude of the force exerted between the face of a nut and that of a bolt head. Increasing pressure is applied between washers as a nut is tightened on a bolt. Progressive compression and deformation of individual spacers take place in an order determined by the specific characteristics of resilience of each spacer. Assuming that adjacent spacers have characteristics of resilience needing progressively increasing amounts of force to effect deformation, one spacer would deform first, followed in turn by the next as additional pressure is applied. As each spacer becomes fully compressed, the adjacent metal faces of neighboring washers come in contact with each other. These faces form two elements of a normally open switch from which electrical connections can be made by wires. Visual or aural electrical indications can be obtained from the process of sequential deformation of the spacers that will show the magnitude of pressure exerted on the transducer assembly.

Notes:

1. This invention is novel in that it provides a broad-range transducer for measuring pressure or torque. Measurements of this type may be useful in such applications as the fabrication of wiring-board terminals, the design and manufacture of weight- and force-measuring equipment, and the fabrication of printed wiring-board connectors.

(continued overleaf)

2. A prototype version of this device has been devised in which a transducer-punch combination is mounted in the ram of a press. With a suitable wiring arrangement, the stacked washers acting as switch elements can be used to indicate various levels of pressure by means of a series of yellow, green, and red indicating lights mounted on the punch holder in a convenient viewing position.
3. Documentation is available from:

   Clearinghouse for Federal Scientific
   and Technical Information
   Springfield, Virginia 22151
   Price $3.00
   Reference: TSP69-10364

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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